REPORT OF THE WORKING GROUP ON
NEFC/SEFC MARINE MAMMAL RESEARCH.
RESULTS OF THE MEETING HELD
8-9 JANUARY, 1985

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April 1985

NOAA Technical Memorandum NMFS-SEFC-168

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A.   INTRODUCTION

The first meeting on NEFC/SEFC Marine Mammal Research Planning convened at the Southeast Fisheries Center on 8-9 January 1985. Facilities for the meeting were provided by the Cooperative Institute for Marine and Atmospheric Studies (CIMAS), on the campus of the University of Miami's Rosenstiel School of Marine and Atmospheric Science. Participants, representing NMFS Headquarters, Northwest Fisheries Center, National Marine Mammal Laboratory (NMML), Northeast Regional Office (NERO), Northeast Fisheries Center (NEFC), Southeast Regional Office (SERO), and Southeast Fisheries Center (SEFC), are listed in Appendix 1.

The impetus for the meeting resulted from the need to better coordinate NMFS research activities on marine mammals in the Northeast and Southeast Regions. In the face of diminishing resources for research, coordinated research efforts on species of joint concern are necessary to meet both specific Regional and more general National needs. Since a number of the large cetacean species migrate between regions, management oriented research needs on these species was the focus of the meeting.

This document summarizes the discussions held at the meeting and forms the basis for developing coordinated research plans for marine mammals in the western N. Atlantic, Gulf of Mexico, and Caribbean. The intended audience for the report are those within the NMFS that are responsible for managing and conducting research on these species.

B.   OBJECTIVES AND FORMAT

The objective of this document is to provide an outline of research needs to guide future coordinated research efforts on large whales in the Northeast and Southeast Regions. The plan formulated shall address both specific Regional needs as well as National needs. The report is intended to offer a realistic approach to meeting NMFS responsibilities for research on and management of these species stocks.

The format of the report follows the general format of the meeting agenda (Appendix 2). However, some specific subsections identified in the agenda have not been treated independently. Other topics discussed, though not identified as specific agenda items are included in the pertinent sections. The remainder of the document provides an overview of the respective Regional and National perspectives on marine mammal research, a summary of our current state of knowledge for the species stocks of concern, identification of data gaps and research activities needed or appropriate to address these gaps. The final section of the report identifies research activities of high priority and describes "core" research activities from which a time-series data base necessary to monitor population trends in the region can be developed.

C.   OVERVIEW

C. 1. National Perspective: Research Responsibilities

The primary NMFS research goal for marine mammals is to ensure that these species stocks are increased to or maintained at a level of optimum sustainable population (OSP). OSP is defined as "...the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element". And, it is towards this management goal that NMFS research is directed through a multidisciplinary program covering various species of whales, seals, and porpoises.

Most of NMFS research is mandated through the legislation of the Marine Mammal Protection Act of 1972 as amended. In addition, other authorities or groups affecting our research include the Endangered Species Act of 1973 as amended, the Convention on Conservation of Antarctic Marine Living Resources, the International Whaling Commission, the Marine Mammal Commission, the International Council for the Exploration of the Seas, etc. In almost all of the legislated mandates, research responsibilities are vague and specific research activities are seldom included.

Occasionally, specific research activities are mandated by Congress with or without funding. For example, money has been authorized and appropriated to conduct entanglement studies. Funds have also been authorized but have not been appropriated to conduct a 5-year assessment of populations of porpoise associated with the ETP tuna fishery. At other times, research may be undertaken as part of a coordinated international effort.

NMFS has a responsibility to conduct protected species research, and it is one of our priority funded endeavors. NMFS also has other priority such as fishery stock assessment and habitat research, mandated by other Congressional Acts. In addition, other programs as product quality and safety, and enhancement of public stocks vie for funding. Today, with a difficult funding situation confronting us, and one which will probably continue at least into the near future, research must be conducted which will provide answers to management needs. It is these needs which dictate our research efforts. The Office of Science and Technology is working with, and will continue to work with the Centers, Regions, and other offices to identify priority research items, and see to it that our responsibilities are met in light of the total NMFS program and the current funding status.

C.2   Regional Perspectives

C.2.i NE Management Needs and Concerns

The NE Regional Office and Center have been working cooperatively since 1981 to utilize the funds designated for marine mammal research in an efficient manner to meet our highest priority information needs. To assist the Center in this task, the Region initially provided an intuitive ranking of information needs by species, area, and threat, based on the regional marine mammal issues faced at that time. Competition for the static level of available Center funds increased, as did criticism of the NMFS's choice of marine mammal research proposals that were funded. Recognizing that the competition and criticism would only increase with time, the Region attempted to quantify the ranking of information needs that are used to provide recommendations to the Center.

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The Northeast Regional Office developed a series of matrices that attempt to quantify the rankings. Although the numbers generated within each matrix remain intuitive, the complexity or number of variables used may even out some bias. Peer review of the numbers used in the martrix, or use of the Delphi Technique, would provide more objective numbers. These methods would be followed if there is agreement that these matrices are useful management tools. Details of the technique used may be found in Beach (1985).

This analysis is useful in developing recommendations to the Center on the direction of their marine mammal research efforts throughout the region. It can also be used to advise other Federal agencies on the type of research needed within a specific area to address the information needs required to assess the impacts of that agencies' specific activity. The technique can also be used to develop and/or support: (1) decisions on certain marine mammal issues such as Recovery Plans, (2) in-house decisions such as budget documents and CYOPs, or (3) as in this case, develop research/management plans. In this manner the priority areas for management-oriented research on large whales in the region relative to specific activities have been identified in figure C.1.

C. 2.ii. Research Addressing NERO Needs and Concerns

The Northeast Regional Office and the Northeast Fisheries Center carry out the responsibilities of the National Marine Fisheries Service in the Northeast Region. The Regional Office fulfills administrative responsibilities and the Northeast Fisheries Center conducts research and provides scientific information in support of the Regional Office.

Marine mammals are an important component of the Continental Shelf ecosystem of the Northeast Region. Recent information indicates that marine mammals probably consume at least as much fish as is harvested by man (Scott et al., 1983). The actual effect of this competition for fish between marine mammals and humans is yet to be determined.

There are also non-biological interactions between marine mammals and fisheries. Several species of endangered and non-endangered marine mammals are killed incidentally in commercial fishing (fixed and mobile gear) operations. In the Mid-Atlantic region the incidence of accidental take of marine mammals has a potential to increase as domestic fishermen enter into joint venture operations for squid, butterfish and mackerel. The expansion of fixed gear (gillnet) operations in the Gulf of Maine, likewise, has a potential to increase the incidental take of marine mammals.

Interactions between humans and marine mammals are not limited to fishing. The rapid expansion of the whale-watching industry is indicative of the aesthetic and non-consumptive economic value of marine mammals. But as the industry expands, particularly in near-shore areas where marine mammals congregate (e.g., Stellwagen Bank), there is a potential adverse effect on the marine mammals.

Guidelines have been developed for vessel operations in the vicinity of marine mammals in order to avoid potential harassment. By and large the industry is conscientious about observing these guidelines. Nevertheless, the behavioral effects (and their population significance) of vessel traffic in the vicinity of marine mammals is not well understood. Whale-watchers

are not the only vessels in the vicinity of marine mammals. Marine mammals are found in the vicinity of fishing operations and in areas of heavy commercial traffic.

The entire marine ecosystem, including marine mammals and habitats essential to their survival may be affected by exploitation of non-living resources (e.g., oil and gas), offshore dumping, and contaminant loading from rivers. The degree of threat to marine mammals depends on their spatial and temporal distribution and their ecological interdependencies.

Ultimately, the effects of human activities on marine mammals will be reflected in population responses. The Marine Mammal Protection Act was promulgated because some species had been depleted to dangerously low levels and because human activities were threatening the rookeries mating grounds, and areas of similar significance to marine mammals. While these populations are now protected from harvest, it remains to be demonstrated whether or not depleted populations are now recovering.

The NEFC has funded marine mammal research since 1980. This research is focused on the major management needs identified by the NERO. The directed research falls within one or more of the major research issues categories: marine mammal fishery interactions, human activity (excluding fishing) - marine mammal interactions, recovery of endangered and threatened marine mammal species, and miscellaneous. Large whale directed research addressing NERO needs funded in FY84 is represented in Table C.1.

C 2.iii. SE Management Needs and Concerns

The principal Southeast Regional Office (SERO) management needs and concerns for the large cetaceans deal primarily with the status of endangered whales. This information is necessary for the SERO responsibilities for Section 7 consultations under the ESA. In the SE region, immediate emphasis is given to the abundance and distribution of wintering humpback whales (Megaptera novaeangliae) in Puerto Rico and the Virgin Islands and the specific determination of the breeding/calving areas of the right whale (Balaena glacialis). Because these two species seasonally inhabit the shallow coastal areas of the southeast US and Caribbean, they are increasingly exposed to human activity that may cause adverse impacts. Although other endangered cetaceans are known to inhabit the region, their distribution appears to be more pelagic in nature, thus lessening their exposure to human activity. The following are potential problem activities and examples of ESA Section 7 consultations that are of immediate concern.

1. Outer continental shelf oil and gas leasing and exploration for the South Atlantic Region.

    Concern for the potential affects on whales of:

    A. Oil spills on food resources, feeding, calving, behavior, etc.
    B. Noise and shock waves associated with seismic exploration.
    C. Increased vessel traffic.
    D. Increase in low flying aircraft (may have significant affects in calving areas).
    E. Cumulative effects of oil and gas exploration.

2. Continued oil and gas exploration and production in the Gulf of Mexico.

3. EPA Designations for offshore disposal sites

   A. Of particular concern are four disposal site designations for dredged material in Puerto Rico (offshore San Juan, Arecibo, Mayaguez, and Ponce Harbors). The EPA's Federal Environmental Impact Statement for the designation of the San Juan disposal site contains no reference to any humpback populations in Puerto Rico. A better understanding of humpback abundance, distribution and movements in the Puerto Rico area would enable us to better evaluate the affects of such projects.

   B. Offshore disposal site designations for dredge material continues along the southeast US; therefore, calving areas for right whales may be affected.

4. Entanglement associated with fishery activities (photo-identified right whales display a high percentage of scars/injuries that are indicative of rope and netting around the tail).

5. Effects of pollution on large whales and their food resources.

6. The determination of whether there is a potential whalewatching/harassment problem in the Virgin Islands or Puerto Rico (and if guidelines need to be implemented in the SE).

In summarizing SERO's needs, we therefore are concerned with the increasing human impacts on the endangered whales with emphasis on right whales and humpbacks. The density of wintering right whales off the Florida/Georgia border is of special concern along with the identification of other sensitive calving areas that may occur in the SE.

C.2. iv. Research Addressing SERO Needs and Concerns

The Southeast Fisheries Center (SEFC) Marine Mammal Program was started in October 1978 in response to the requirement for bottlenose dolphin (Tursiops truncatus) live-capture fishery management advice. Marine mammal research at the SEFC has been shaped to its present form by recommendations developed during a continuing series of internal and external reviews, the most recent of which occurred during the SEFC Stock Assessment Workshop in August 1982 and June 1984 and by the US Marine Mammal Commission in February 1983.

The present goals of the Marine Mammal Program at the SEFC are: 1) to provide estimates of abundance and live-capture quota recommendations for the stock(s) of bottlenose dolphins occurring in the southeast, 2) to determine the dynamics and discreteness of along-shore and inshore-offshore populations of Tursiops, and 3) to determine the validity of the live-capture quota guidelines developed by the Marine Mammal Commission. These research goals are being pursued using a variety of research tools and methodologies including aerial sampling surveys, tagging studies, photogrammetry and genetics research.

Because the SEFC Marine Mammal Program has targeted _Tursiops truncatus_, research on large whales to date has been opportunistic in nature. However the intensive research phase on _T. truncatus_ is expected to run to completion and replaced by a less intensive monitoring program by FY87. Beginning in FY87 SEFC directed research on large cetaceans is expected to begin.

D. SUMMARY OF CURRENT KNOWLEDGE[1]

Right Whale, _Balaena_ or _Eubalaena glacialis_

One of two balaenid species, the right whale is found in all oceans from temporate to Arctic and Antarctic coastal waters. Seasonal movements are either north-south and coastal, or east-west to offshore areas for feeding and breeding. There are at least three isolated reproductive units, in the N. Pacific, N. Atlantic, and Southern Hemisphere. It remains unclear if animals along west central Afica are separate or intermix with north-south Atlantic animals. Stock identification is not clear for some oceans, but there are perhaps one or two stocks in the N. Pacific, up to three in the N. Atlantic and perhaps seven to eight in the southern oceans: west S. Africa, Argentina, Chile, New Zealand, Cambell Islands, Australia (maybe two here) and south Indian Ocean (east of S, Africa). Right whales are primarily copepod feeders, but also take euphausiids. Calves are produced in late winter, adult females having a calf every three to four years (range 2-9 years). Sexual maturity is reached at about 8 years, at about 40-50 feet long in females. The theoretical recruitment rate of calves is about 5-9%; however, observations of a population increase of 7% and recruitment at 15-25% off S. Africa have been recorded. A lack of juvenile animals seen in this population suggests only a portion of the population has been seen and thus this recruitment rate of calves is too high. Data for Argentina suggest the rate is closer to 4-7%. Whaling for right whales was the easiest of the "commerical" whaling operations, and began as most did, in the N. Atlantic. Based upon the number of right whales killed during the modern era (well over 200,000 during the 1800's alone), the initial world population was at least 100,000 to 300,000 animals. The world population size today is perhaps no more than 3,000-4,000, or about 1-4% of initial. Right whales are the most depleted of all great whales, and because of its lack of recovery in most areas (S. Atlantic perhaps an exception), and coastal habits, the species should remain listed as endangered (Braham, 1984).

In the western N. Atlantic, right whales are seasonally abundant in relatively localized areas such as the Great South Channel, at the mouth of the Bay of Fundy and on Brown's Bank. During the winter period, an aggregation of right whales has been observed off the north Florida - south Georgia coast. Adult-sized animals with calves have consistently been observed in the Southeast Regional Atlantic waters defining the winter periods. Most observations of right whales in the Southeast Region are made from the shore. There is relatively little effort away from the coasts. It has been hypothesized that the Atlantic waters off Florida - South Carolina represent the calving/breeding grounds for this stock of right whales. There is no estimate of the initial size of western N. Atlantic right whales. However, sufficient data may be available to estimate the pre-1800's stock size for this species. The 95% interval peak average seasonal abundance estimate for right whales in the Northeast Region ranges from 85-1076 with a point estimate of 380 based on the CETAP (1982) data. Most researchers consider this stock of right whales to consist of a few hundred individuals (Table D.1).

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[1] See Breiwick and Braham (1984) for greater details and overview of the endangered species

Blue Whale, Balaenoptera musculus

Found in all oceans, blue whales migrate from their winter breeding grounds in low latitudes to summer feeding areas in the subarctic and Antarctic. A distinct pygmy blue whale (same species) occurs in the southern Indian Ocean to 55°S. Males and females reach sexual maturity at 5-15 years; a calf is produced every second year, with gestation lasting one year, and weaning at 7 months after a growth from birth of 23 ft. to 53 ft. The primary prey is Euphausia sp. and Thysanoessa sp. The current world's population (about 90% residing in the Southern Hemisphere) is estimated at 10,000-15,000, about 5-8% of its initial size of perhaps 200,000 prior to commercial whaling. Commercial whaling on blue whales began in the mid-1800's, but most were fished out from 1920 to 1955. Based on the unknown rate of recovery, if any, and the low population sizes (and presumably low densities in former areas of the abundance) we conclude that all stocks of blue whales remain listed as endangered (Braham, 1984).

In the western N. Atlantic the remnant summer distribution of blue whales is believed to range northward from Nova Scotia and the Gulf of St. Lawrence to the Arctic pack ice. The southern limit of species winter range is unknown, but stranding records indicate occurrence in the Mid-Atlantic to Gulf of Mexico waters. The initial stock size of N. Atlantic blue whales is estimated to have ranged from 1110-1500 individuals. The current population is estimated to consist of about 100 individuals, representing 6.7%-9% of the initial stock size estimate (Table D.1). Observations of blue whales in the western N. Atlantic south of Nova Scotia are rare events.

Fin Whale, Balaenoptera physalus

As with blue, and other balaenopterids, fin whales apparently move towards subarctic and Antarctic waters seasonally, and the Northern and Southern Hemisphere populations are 6 months out of phase, hence they are considered reproductively isolated. The same is thought for the Eastern and Western Hemisphere. Fin whales range over a wider geographic and latitudinal range than either blue or sei whales; however, stocks within hemispheres may intermix. Reproductive parameters are very similar to blue and sei whales, as well, although weaning may last longer (ca. 7-11 mo.). Fin whales feed on a wide variety of prey including krill - Euphausia, Thysanoessa; and fishes - Mallotus (capelin), Clupea (herring) and anchovies (Engraulis). The current world's population is probably less than 125,000, or about 25-30% of the population of perhaps 450,000 prior to commercial whaling. Estimates of current abundance, however, are generally poor, and for some stocks (e.g., northeast Atlantic) no estimates are available. Considering most stocks are only a fraction of their former size, and their rates of recovery are unknown, fin whales as a species should remain classified as endangered (Braham, 1984).

In the western N. Atlantic, fin whales are cosmopolitan ranging from Greenland to the Caribbean. Two stocks of fin whales have been hypothesized to exist along the N. American Atlantic coast. Some evidence exists suggesting a third, separate stock of fin whales existing year-round in the Gulf of Mexico. North of Cape Hatteras to Nova Scotia, the seasonal distribution patterns of this species have been described. Stranding records indicate occurrence of this species along the Southeast Region Atlantic coast from late fall through early spring.

There are no estimates of the initial stock size for N. Atlantic fin whales. The currently accepted estimate of western N. Atlantic fin whale abundance ranges from 3590-6300 individuals (Table D.1). This estimate may be low, however, in view of the recent estimate of fin whale average peak abundance from Cape Hatteras to Nova Scotia of 5423(+ 3141, 95% CI) based on CETAP (1982) data. Fin whales are the most abundant endangered whale species in shelf waters of the western N. Atlantic. No estimates of fin whale seasonal abundance are available in the Southeast Region.

Sei Whale, Balaenoptera borealis

Third largest of the balaenopterid whales (up to 60 ft.), little is known about this species, and much is presumed by comparison with B. physalus and B. musculus. From modern commercial whaling records, which only began in this century, it is found to be a more temperate species than blue or fins, seldom ranging above 50° latitude, except perhaps in the N. Atlantic (up to 72°), but their wintering areas are unknown. The IWC classifies sei whales into three stock areas in the N. Pacific and N. Atlantic, and six in the Southern Hemisphere, the latter being "statistical areas" (I-VI) for most commercial species, rather than truly identified stock boundaries (breeding or distinct feeding units). Sei whales specialize on copepods, but also feed on euphausiids and small schooling fish when copepods are scarce. The Icelandic stock is the only group harvested today in the N. Atlantic. The current world's population is about 50,000 or about one-half the estimate before the 1930's. Estimates of local stock abundance around the world are poor, however. Because of the low population estimates for most areas and unknown recovery rates, sei whales as a species should remain classified as endangered (Braham, 1984).

In the western N. Atlantic, sei whales are distributed from the Gulf of Mexico and Caribbean regions to Nova Scotia and Newfoundland. In the Northeast Region, this species tends to aggregate seasonally along the shelf beak from Hydrographers Canyon to the northeast edge of Georges Bank. Outside of strandings, little information is available for the other parts of the species range in US waters. No estimates of the initial stock size of N. Atlantic sei whales are available. However, since commercial exploitation of this species has been limited to the present century, sufficient data may be available to estimate pre-commercial whaling stock size. The current stock size estimate for N. Atlantic sei whales is 4,957 (Table D.1). There are an estimated 1398-2248 individuals in the IWC Nova Scotia management stock (Mitchell and Chapman, 1977) which, presumably, includes animals seasonally inhabiting both Northeast and Southeast Regional waters. Recent, conservative 95% interval estimates of sei whale seasonal abundance in the Northeast Region range to 593 individuals, with an average point estimate for in the spring season of 280. These estimates may be biased negatively by a factor of 3-5 due to animal diving behavior (CETAP 1982). No abundance estimates are available for other parts of the range.

Bryde's Whale, Balaenoptera edeni

Bryde's whales are found in warm temperat and tropical waters in all oceans. In the N. Atlantic, these whales have been reported from Virginia, the northeast Gulf of Mexico, the Caribbean and southern West Indies. This species is the only rorqual that does not migrate to high latitudes to feed

and to nurse its young. Bryde's whales feed on clupeid, scombroid, and
mesopelagic fishes as well as a variety of plankton. Adult animals are bet-
ween 43 and 45 feet long, reaching sexual maturity when 40 to 41 feet in
length. In S. Africa waters, they breed year round, while in the northern
hemisphere, breeding probably occurs November through February. Gestation
lasts about one year.

Data from S. Africa and the N. Pacific suggest that although the popula-
tion estimates are being developed, the process has been complicated by the
use of data containing misidentified sei whales. The N. Pacific population
is estimated at about 20,000 whales; the population off Peru at 15,000
-20,000. Estimates for the Atlantic are pending satisfactory assessment.
This species is not considered endangered.

Minke Whale, Balaenoptera acutorostrata

The minke whale, the smallest balaenopterid, is a cosmopolitan species
which migrates across the tropical, temperate and polar latitudes. In the
N. Atlantic this species feeds on gadoids and clupeids, notably capelin. In
the southern hemisphere, its diet consists primarily of krill, although
mackerel, herring and whiting are also preyed upon. Adults range from 22 to
33 feet in length. Sexual maturity occurs at about 7 to 8 years of age in
the northern hemisphere and at age 6 to 7 years in the southern hemisphere.
Females usually give birth annually, producing a calf 7.9 to 9.2 feet long
which is weaned approximately six months later. This species is not con-
sidered endangered.

This species is the only baleen whale taken commercially in the southern
hemisphere where its population is estimated at greater than 300,000. The
N. Atlantic population is estimated at between 80,000 and 120,000 whales.
Local assessment of the Northeast Regional waters indicate that a minimum of
1.7 - 2.5 % of this estimate frequent the waters over the US outer continen-
tal shelf. An estimate for the Southeast Region has not been developed.

Humpback Whale, Megaptera novaengliae

Grouped as a balaenopterid whale, humpbacks occur in all oceans but
are much more coastal seasonally than any other of this large group of
rorquals. Migration is similar: to high latitudes during the summer feeding
months and to temperate and tropical winter breeding grounds. They appear
to invade higher and lower latitudes than most if not all other whales,
ranging from near the equator to well into polar waters, although probably
not into the pack ice. Stock identification is difficult because it is
generally unknown how much intermixing occurs on the winter breeding
grounds. However, stock separation on the basis of feeding aggregations has
been a useful management tool (since at least one group is still harvested
in summer, i.e., W. Greenland). There are at least three breeding aggre-
gates in the N. Pacific, and perhaps three along the Antillean chain in the
West Indies. Other stocks are thought to be in the Arabian Sea (one), and,
as with other whales, in the statistical areas of the Southern
Hemisphere-Australian region (six). Separate stocks occur along the coastal
corridor and areas east and west of Australia and New Zealand, S. America
and Africa. Humpbacks feed primarily on euphausiids and schooling fishes,
in the Northern Hemisphere, but mostly euphausiids in the Southern

Hemisphere. Sexual maturity is reached at about 9 years of age, and the calving interval is 2 years, although apparently may vary from 1-3 years. Gestation and lactation last about 12 months, with calving occurring in winter. Modern whaling began in the mid-1800's in the N. Atlantic, and ended in the 1960's. Approximately 10-15 are killed each year from the N. Atlantic stock(s). The current world's population is about 10,000 or approximately 8% of its initial size prior to commercial whaling of about 120,000. The western N. Atlantic stock may be near its initial size, and if so, has perhaps recovered or never was overexploited. All other stocks are probably very low relative to initial size. Because of low populations sizes, unknown recovery rates, and dependence upon coastal habitats for calving, rearing and feeding, the species should remain listed as endangered (Braham, 1984).

In the western Atlantic, the general distribution patterns for feeding and breeding grounds are well described. It is apparent, however, that information is lacking in numerous specific areas of the range, including the US Virgin Islands, Puerto Rico and in the Lesser Antilles where a limited harvest persists. An hypothesis of stock structuring for western N. Atlantic humpbacks suggests that the Lesser Antilles stock is the same as that currently harvested off W. Greenland. The estimated initial stock size of western N. Atlantic humpbacks is some number greater than 4,400. The current western N. Atlantic stock estimate ranges from 5,257-6,289 (Table D.1) The estimated peak average seasonal abundance of humpbacks in the Northeast Region based on CETAP (1982) data ranges to 1,248 (95%CI) with a point estimate of 658 individuals.

Sperm Whale, Physeter macrocephalus

The only true schooling great whale, the sperm whale, occurs in all oceans widely ranging over mostly pelagic, deep waters (>100m). It is found from tropical to subarctic areas, but mostly remains in temperate waters. Generally, only adult males are found in higher latitudes (sub-arctic) during the summer feeding months with younger males and females spending this season farther south. Major sperm whaling grounds, a reflection, presumably, of summer distribution in the Pacific, were the Gulf of Alaska, Hawaiian Islands, Bonin Islands, coast of Japan to Midway Island, mid-Pacific equator, northwest coast of S. America, Chile, north of New Zealand, west Australia and east of Java and accompanying islands to the Philippines. In the Atlantic and Indian Oceans it was Iceland, British Isles, central N. Atlantic, Gulf of Mexico, northwest Africa, west Central Africa, Brazil and Argentina, Tristan to S. Africa, Madagascar, Arabian Sea, Sri Lanka, west coast of Viet Nam and the "Antarctic grounds" between 55° and 65° (six "stock" areas). Sperm whales feed primarily on squid, but also take, in higher latitudes, large demersal and mesopelagic sharks, skates, and fishes. Breeding schools consist of 20-40 females and juvenile males with usually one or just a few adult males. Male bachelor schools can reach the same size; old males are often solitary. Mating occurs in spring and early summer in higher latitudes. Gestation take about 15 months, and lactation 1-2 years. A calf is produced every 3-6 years. Sexual maturity is reached at 9 years in females, but not fully reached until age 20 (range 9-20+) in males. Commercial whaling was extensive. For example, over 600 whaling ships were stationed in Hawaii in 1846 with most seeking sperm whales up to this peak time.

Later in the century, the shift was to other species such as right, humpback and bowhead whales. The current and pre-whaling population estimates for virtually all stocks are poor, with wide confidence estimates. All estimates are based on catch data, and refer to the "exploitable" population (i.e., those animals greater than about age 10). The present world population size (of perhaps 1,000,000+) appears to be about 70% of its initial size prior to commerical whaling based on comparative statistics of exploitable populations. Taking into account that local stocks are undoubtedly depleted whereas others may not be, consideration for complete delisting is impractical. The world's population is not threatened with extinction, but since no judgement at this time can be made on which stocks need particular protection, over others, the species should be listed as threatened. The critical issue here for listing is the uncertainty of the initial and current estimates. However, clearly the species as a whole is abundant and thus would not seem to warrant "endangered" status (Braham, 1984).

In the western N. Atlantic, sperm whales generally are distributed along the shelf break and into more pelagic waters. This species is occasionally observed on the shelf. In the Gulf of Mexico they have been observed in waters >200m. The initial stock size for N. Atlantic sperm whales is estimated to have been in excess of 116,000. The current stock size is estimated at 99,500 (60% of critical, Table D.1). The conservative peak average, seasonal 95% interval estimate of sperm whale abundance in Northeast Regional waters ranged upward to 462 with a point estimate of 222. (CETAP 1982).

E. DATA GAPS

The information necessary for making recommendations for management actions to achieve the goal of recovering marine mammal species stocks to and/or maintaining them within the defined range of OSP is listed in Figure E.1. At a minimum, it is necessary to know the relative sizes of present and pre-exploitation stocks to estimate the status of the stock, assuming a constant carrying capacity. Given present stock size relative to carrying capacity and the species stock's demographic parameters (recruitment and mortality) it is possible to estimate risks to the stocks of concern under various levels of "take" (as used in the MMPA). Identifying sources and rates of human induced mortality allows for implementation of mitigating management actions.

In the case of marine mammals in U.S. waters, where most of the species stocks are under complete protection, monitoring trends in abundance using a time-series data base is a necessary research application to allow estimating the status of the stocks relative to OSP. In few cases are sufficient time-series data available to analyze trends. This is due to a number of factors including the low intrinsic rate of increase in these species, imprecision in techniques for indexing abundance, and inconsistent methodology used for indexing abundance. Thus, there is a general need for a consistent time-series data base from which spatio-temporal trends in abundance may be analyzed.

The data gaps identified in Figure E.1 cross over many of the species of concern. The following briefly summarizes discussions on the status of knowledge and need for research on the topics and species listed in Figure E.1.

Stock Identification

In general, our knowledge of stock structuring for the species of concern is incomplete. Research is ongoing in part of the species range on humpbacks using chromosome R-branding techniques and individual identification markers. Similar research on individual identification in right whales is also ongoing. Application of mtDNA analysis to large whale stocks as is presently underway for bottlenose dolphins in the southeast may also be appropriate.

Management on the basis of unit stocks, or genetically isolated population subunits, is desirable. However, when a species is afforded complete protection throughout a management area (i.e., no harvest), intensive research on identifying the subunits within management areas is of questionable need.

Because some limited harvest of humpbacks continues in both the feeding areas off western Greenland and in the breeding areas off the Lesser Antilles, there is a more critical need for examining stock structure in the western North Atlantic humpback population. Since right whales appear to be severely depleted and there is little evidence of any response to their protection in 1935, research on stock structuring of this species using genetic indicies may be useful in determining the role of genetic variability in a large mammal population's ability to respond to overexploitation.

Present Stock Size

There are no data available on the present stock size of Brydes whales. Estimates are incomplete for sperm whales and blue whales. Research is ongoing in portions of the species range for right whales and minke whales that will allow abundance estimates for portions of their range. Estimates of the present western North Atlantic abundance of fin whales, humpbacks, and sei whales may be adequate for the purpose of estimating these species status relative to OSP.

Sampling surveys of U.S. jurisdictional waters in the northeast region and the Gulf of Mexico have been completed and/or are underway. These surveys form the basis for regional abundance estimates. Since, in most cases, the species of concern have seasonal population ranges that are larger than those enclosed by regional boundaries, the resulting abundance estimates, taken independently, represent local abundance rather than stock or population abundance. These data, however, form a substantial quantitative basis for examining spatial and temporal changes in abundance and, given sufficient time series, allow analysis of trends.

Virginal Stock Size

No data are available on the "virginal" stock sizes for sei, Bryde's, or minke whales. The present knowledge is incomplete for right, humpback, and sperm whales. There is ongoing research on the virginal stock level for fin whales in the western North Atlantic. The level of knowledge on virginal stock abundance of blue whales in the western North Atlantic is adequate.

Examination of historical records to estimate catch is the sole research technique identified as applicable to estimation of virginal stock size. It is unknown if an adequate data base exists to estimate the virginal abundance of Brydes or minke whales. Since sei whales were exploited in the modern whaling era, sufficient data may be available to estimate pre-exploitation stock levels. Records may be available from local historical records from townships in the northeast and, perhaps, southeast where land-based whaling operations for right whales were located or at ports where vessels called. Tax records from Caribbean whaling ports may also be useful for estimating catch of humpbacks in the region prior to the modern era.

Reproductive Rates/Recruitment

Recruitment is an index to stock status relative to OSP. Since OSP ranges upward from maximum net productivity level (MNPL) to carrying capacity, monitoring both reproductive and mortality rates allows inference about future stock status.

The data available on reproductive rates/recruitment for the species stocks of concern are generally incomplete. Most information comes by way of analogy with other species and stocks. Ongoing research is underway on fin whales, minke whales, and humpbacks in parts of the stock ranges. Research on western North Atlantic right whales is also underway.

Data on recruitment come from a variety of sources. In cases where local population levels are relatively small, residency protracted, and sampling intensive, individual identification using natural markers provides sufficient data for tracking reproductive rates. In other cases, photogrammetric sampling, and to a lesser degree sampling surveys, allow analyses of these reproductive rates.

Causes/Rates of Mortality

Mortality and reproductive rates taken together with stock abundance allow assessment of the risks to the stocks of concern under various levels of take. Mortality has components related to human interactions (incidental take/entanglement, other human impacts) and other natural causes. Mortality rates are more difficult to estimate than birth rates and as such, no data are available on natural mortality rates for most of the species stocks of concern. For fin whales, the available information is based on some photogrammetric studies in the northeast. Research is ongoing on humpbacks and right whales using individual identification catalogues.

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Incidental Take/Entanglement

Some limited data are available on incidental take/entanglement for some of the species of concern. No data are available for blue, sei, Brydes, or minke whales. Because of its pelagic distribution, fishery interactions involving incidental take/entanglement with sperm whales is unlikely. Although mortality due to gear interaction is known to occur, the rates of occurrence are unknown. Limited data are available for right and humpback whales.

Other Human Impacts

Other human impacts on the species stocks of concern include activities such as vessel traffic, outer continental shelf exploration activities, general pollution, etc. These activities as they affect population demographics (increased mortality and/or decreased natality) are of principal concern. In general, the population responses to these activities are unknown. Currently, research is being conducted on the behavioral responses of right whales to vessel activities and on base-line respiration rates in humpbacks.

Historical/Present Density Distributions

The patterns of habitat utilization are of use in correlative analyses relating to the effects of human activities on the species stocks of concern. Research is ongoing in the northeast Region monitoring density distribution patterns. A data base is being developed for a portion of the Gulf of Mexico. No data are available for species density distributions in southeastern Regional Atlantic waters east of the Gulf Stream. Limited data are available for portions of the Caribbean region.

High- vs Low-Use Areas

Marine mammal density distribution patterns are not random. These distributions are likely related to prey density distributions or the distribution of other requirements (e.g., breeding banks). Analysis of the characteristics of high-use areas help elucidate those factors most directly influencing density distribution patterns. Again, by analyzing both the distribution patterns and the ecosystem characteristics associated with high-use regions, actions that may impact marine mammal population recovery through direct and indirect effects of competition or the altering of habitat requirements can be identified and possibly averted. A number of high-use areas have been identified through sampling surveys in the northeast Region. Currently, research on humpback and right whale high-use areas in the northeast Region is being conducted. In general, however, little data are available for the species stocks of concern.

Food Habits/Consumption

Conservative estimates of the total biomass consumed by cetaceans in the northeast Region indicate that the annual removal of fish by these species is greater than that harvested annually by fishermen. The types of prey consumed as well as consumption rates are necessary for multispecies fisheries management decisions. In general, data are incomplete on food habits and consumption rates for the species of concern. Estimates of direct competition rates between fisheries and cetaceans in the regions are dependant upon information on the distribution, abundance, and productivity of the species consumed as well as the consuming species. Data from fishery resource surveys and cetacean sampling surveys need be jointly analyzed to clarify remaining data gaps relative to questions on direct competition.

F. RESEARCH NEEDED TO ADDRESS DATA GAPS

A number of research techniques are available to fill the identified data gaps identified in Figure E.1. The applicability of the techniques discussed is also shown in Figure E.1. The general classes of research techniques discussed included: Sampling Surveys, Data Archival, Catalogues, Genetics, Stranding Networks, Historical Records, and Remote Sensing. A synopsis of the discussion on each of these topics follows.

Sampling Surveys

Two types of sampling surveys were discussed: dedicated aerial sampling and quantitative shipboard sampling using platforms of opportunity (POP). Both types of sampling have a high degree of applicability for all species of concern within a defined study area. However, dedicated sampling has the advantage over POP sampling in that the platform is under control of the researchers involved in sampling.

Dedicated aerial sampling is most useful for near-synoptic density estimation and allows greater temporal/spatial resolution over larger geographical ranges than do ship-based surveys. These surveys provide data on a number of the research areas for which there are information gaps. Dedicated aerial sampling is relatively costly, however.

Shipboard POP sampling has the advantage of lower apparent costs than aerial sampling since this sampling is piggy-backed on other research projects directed at monitoring fishery resources. The data return from this type of effort, however, is not as great as from dedicated sampling since the level of effort is much lower. As with dedicated aerial sampling, POP sampling provides data on a number of the research areas for which there are information gaps. Direct comparisons between ship and aircraft based density estimates may be inappropriate without consideration of the relative efficacies of these platforms for abundance estimation.

Data Archival

A number of the immediate and future management concerns could be addressed in those regions where sampling surveys have been conducted if the data resulting from those efforts were readily available to NMFS scientists and managers in a consistent format. Data from large-scale government-sponsored research efforts such as the CETAP study and Fish and Wildlife surveys in the Gulf of Mexico are not available in an easily accessible format.

Data from several survey efforts conducted or underway in the southeast region are archived on the NMFS B7800 computer in Seattle, but may not be in consistent formats.

Development and implementation of a data archival system allowing retrieval of marine mammal information by user defined geographical boundaries for correlative analyses with other fishery resource data bases such as MARMAP, SEAMAP, and the groundfish surveys data bases are needed. Specification of data formats consistent with the archival system format in future contracts is also required.

Catalogues (Individual ID)

Individual ID catalogues appear to be potentially useful in estimating present stock size using mark-resighting sampling experiments, in estimating recruitment and mortality rates, in examining density distribution behavioral patterns (migration) and, to a more limited degree, in stock identification. The cost of maintaining a catalogue is relatively low, although the cost of obtaining the imagery for the catalogue can be high.

The application of a catalogue is not useful for all species stocks since only relatively few species have easily recognizable individual markers. In cases where stock size or local abundance is relatively large or far ranging, the likelihood of a catalogue providing estimates of individual recruitment or mortality rates is diminished.

Genetics

The principal use of genetics studies is in the definition of stock structure. Since most genetics studies are developmental, subject to high variability in experimental protocol, and since most species stock of concern are not harvested, this research is of limited utility except in special cases where harvest exists or where there are very low population levels. The costs of such studies are relatively low, given that adequate tissue samples are easily available for analysis.

Stranding Network

Stranding networks have general utility for most species. At present, their principal use is in identifying causes of mortality. The use of stranding data to estimate population structure (i.e., age-sex distributions) is not likely to produce reliable results since one must also independently estimate age- and sex- specific stranding probabilities to use these data. Estimation of mortality rates from stranding data is usually not possible. In limited special cases where stranding data collection effort is quantified and sufficient independent estimates of abundance are available, mortality rates can be estimated. Stranding networks do provide a source for biological samples which can be used in other research applications. Analyses of tissue pesticides, heavy metals, and other pollutants may serve to provide a data base for indexing ecosystem "health". These data may provide a basis for detecting and interpreting the effects both chronic and acute environmental pertubations.

Historical Records

Analysis of historical records is the only way to estimate "virginal" stock size. These records also provide data on historical density distribution patterns, high-use areas, and food habits (based on gut contents of captured whales). Analysis of historical records is generally relatively low cost, but labor intensive.

Remote Sensing techniques discussed included radio tags, satellite imagery, sonar and photogrammetry. As a class, these techniques are generally high technology/high cost. In many cases, the techniques have limited application for specific research questions relative to OSP. Photogrammetric techniques may prove useful for estimation of vital rates. Satellite-linked transmitters may be the only feasible means of answering questions on seasonal movement patterns for relatively low abundance species such as right whales. In order to apply this technology (ie satellite transmitters) though, much costly, fundamental research must first take place. In light of expected funding levels for cetacean research in the region and the management goal of OSP, near term development costs for this technology may be too high for the expected return relative to other research priorities.

G. PRIORITY CONSIDERATIONS FOR RESEARCH

The large whale species stocks of greatest immediate concern in both the northeast and southeast regions are the right and humpback whales. This concern is due to the perceived potential for adverse impacts of human activities on the stocks' recovery to OSP level. Because the right whale stock(s) are considered to be well below OSP, and since humpbacks may be closer to OSP, higher priority is given to research directed at right whales.

Specific research activities recommended follow:

o   Develop time-series data base for monitoring abundance trends.

o   Estimation of right whale current stock size using sampling survey and mark-recapture data.

o   Estimate catch history of right whales using historical data to allow estimation of pre-1800 stock size.

o   Describe density distribution patterns and habitat usage in the hypothesized right whale breeding areas off the southeast US coast using sampling surveys (POP or dedicated sampling if POP alone is inappropriate).

o   Estimate recruitment and causes and rates of mortality in right whales using individual ID catalogue, sampling survey, and stranding network data.

o   Estimate recruitment and causes and rates of mortality in humpbacks using individual ID, sampling survey, and stranding network data.

o   Characterize high-use areas in the feeding and breeding range where human interactions with large, endangered whales are likely.

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o   Define humpback density distributions in US Caribbean waters where
    ocean dumping activities are proposed.

o   Estimate abundance of humpbacks in Caribbean waters (using com-
    parable sampling to that previously used), especially the Lesser
    Antilles, where an annual harvest continues, to monitor response to
    protection and estimate status relative to OSP.

o   Examine historical records of land-based fisheries for humpbacks in
    the Caribbean to estimate historical catch levels and estimate
    pre-1800 abundance.

o   Develop protocol for stranding response team to recover biological
    data from stranded endangered whales.

Core Cooperative Research Activities

Development of a time series data base is a necessary research applica-
tion for monitoring population trends and estimating stock status relative
to OSP. Archival of these data in an easily retrievable format, consistent
with other time-series data bases for marine resources, is a necessary step
in the development. Also necessary is the application of consistent and
comparable sampling techniques in collecting the data. A number of the high
priority research recommendations involve application of sampling surveys.
Most of the present information available on marine mammals come from either
dedicated aerial or POP sampling surveys. Although the two types of
sampling may not be directly comparable, they are complementary.

For these reasons, the proposed core cooperative marine mammal research
activities for the NE and SE involves a combination of long-term POP survey
sampling and dedicated aerial/ship sampling. POP survey sampling shall be
continuing annually and implemented in regions where it is not currently
underway to monitor density distributions. Dedicated sampling within six or
more regions in the US Atlantic and Gulf of Mexico spaced at intervals of
five or more years, are recommended for use in monitoring population trends
in a fashion consistent with surveys previously conducted.

In support of developing the core research activities several proposed
projects will be undertaken. These include development of a data archival
system and accumulation of available data to that system, transfer of quan-
titative shipboard sampling technology for marine mammals between the NE,
NW, SE, and SW Centers via a cooperative cruise, and development of sampling
designs for rotational aerial surveys and POP surveys in regions where they
are not presently active.

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Table C.1. Large Whale research supported by the Northeast Fisheries Center from FY-1984 and, in part, FY-1985 funds.

Organization/ Principal Research	Project Title	FY-1984 Funding Period	Project Summary
Provincetown Center for Coastal Studies/ D. Mattila	1984 Fluke Identification survey and song recordings of Humpback Whales (Megaptera noveangliae) along the northwest coast of Puerto Rico.	7K FEB - APR 1984	Humpback whale flukes were photographed to update and establish new matches in the humpback whale catalogue maintained by the College of the Atlantic. Photographs were taken to document surface behavior, and habitat use. Humpback songs were recorded which will be analyzed to determine their relationships in social interactions. The songs will also be compared to humpback songs from other regions.
University of Florida/ R.H. Lambertsen	Biopsy studies of the North Atlantic humpback whale (Megaptera novaeangliae) for karyologic determination of the sex of photographically identified individuals.	0.3K	The NEFC provided funding for one-week charter to collect humpback whale tissue sections on Stellwagen Bank in September 1984.
College of the Atlantic/ S.K. Katona	Maintenance of the humpback whale catalogue.	23.1K 1 OCT 84 - 30 SEP 85	Dr. Katona will continue to collect, analyze and archive humpback whale fluke photographs taken by marine mammal researchers in the North-west Atlantic. To date, the catalogue of individually identified humpback whales has grown to about 3,000 animals.
Manomet Bird Observatory/ P.M. Payne		52.5K 1 OCT 84 - 30 SEP 85	Continue to use NEFC and other research vessels as ships of opportunity to define the distribution and abundance of marine mammals in the northeast region (Cape Fear, North Carolina to Nova Scotia).
Provincetown Center for Coastal Studies/ C. Mayo	A Proposal to Study Right and Humpback Whales and Habitat Usage of Stellwagen Bank and Cape Cod Bay.	22.0K 1 OCT 84 - 30 SEP 85	To define the high use habits of right and humpback whales in the Cape Cod Bay-Stellwagen Bank region. The high use areas will be sur-veyed to determine the biological, chemical, and physical parameters which make those areas preferred by right and humpback whales. The social interactions of these two species with-in these areas will also be defined.

Table C.1.   (Continued)

Organization/ Principal Research	Project Title	FY-1984 Funding Period	Project Summary
Woods Hole Oceanographic Institution/ W.A. Watkins	Assessment of Marine Mammal Reaction to Human Activities from Observations over the Last Twenty-Six Years.	23.8K 1 OCT 84 - 30 SEP 85	Review 26 years of observation data on marine mammals. This analysis of selected data will compare present day large cetaceans behavior to vessel (e.g., whale watching, fishing, merchant, etc.) traffic and human activity to past behavioral responses. From these obser- vations the future effects of human activities on marine mammal populations will be extra- polated.
University of Florida/ R.H. Lambertsen	Biopsy studies of the North Atlantic Humpback Whale (Megaptera novaeangliae) for Karyologic Determination of the Sex of Photographically Identified Individuals.	22K pending	Humpback whale skin samples will be collected using a crossbow and dart. Tissues will be cultured to determine sex of photographically identified individuals. Additionally, the chromosomal patterns will be determined from R-banding techniques for stock identification studies.
College of the Atlantic/ G.S. Stone	Respriation Rates of Undisturbed Baleen Whales	6K pending	To analyze over 500 hours of respiration rates for finback, minke, humpback, and right whales collected from Mount Desert Rock, in the Gulf Maine, since 1973.
University of Rhode Island/ H.E. Winn	Right whales in the Great South Channel	33.4K 1 OCT 84 - 30 SEP 85	Aerial photographs will be taken in the spring of 1985 in the Great South Channel to estimate right whale population size, and residency times. The GSC is believed to be the main corridor used by right whales entering the Gulf of Maine.

Table D.1. Summary population estimates for large endangered whales for the
N. Atlantic. In several cases, the western and eastern N.
Atlantic could not be separated. Where separated, footnote b/
is used to denote western N. Atlantic. Information summarized
from available published literature reported by Braham (1984).

| Whale Species | Population Size | | Approximate Percent of Initial |
	Initial a/	Current	
Blue	1,100-1,500	100	6-9%
Fin b/	NE	3,590-6,300	NE
Sei	NE	4,957	NE
Humpback b/	>4,400	5,257-6,289	recovered ? c/
Right	NE	low hundreds	<36%
Sperm	166,600	99,500	60%

a/ Based on analysis of commerical and other whaling logbooks type data,
and may not be very precise.

b/ Western N. Atlantic only (essentially Caribbean to Greenland).

c/ "Recovery" means that current estimate is sustantially greater than 60%
of initial and probably near initial.

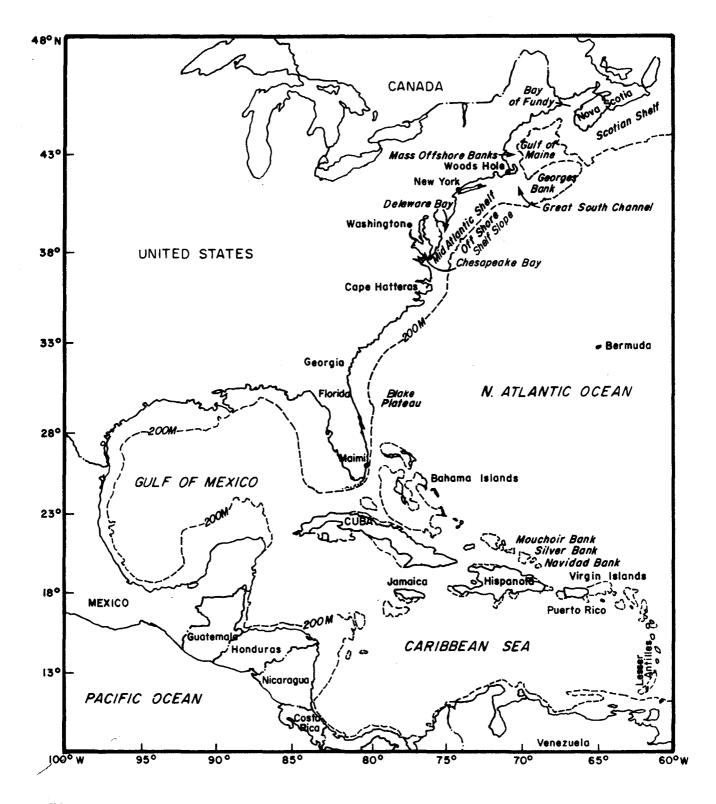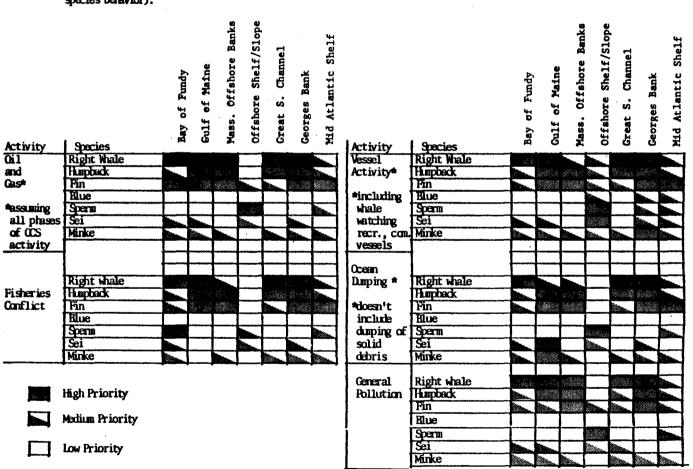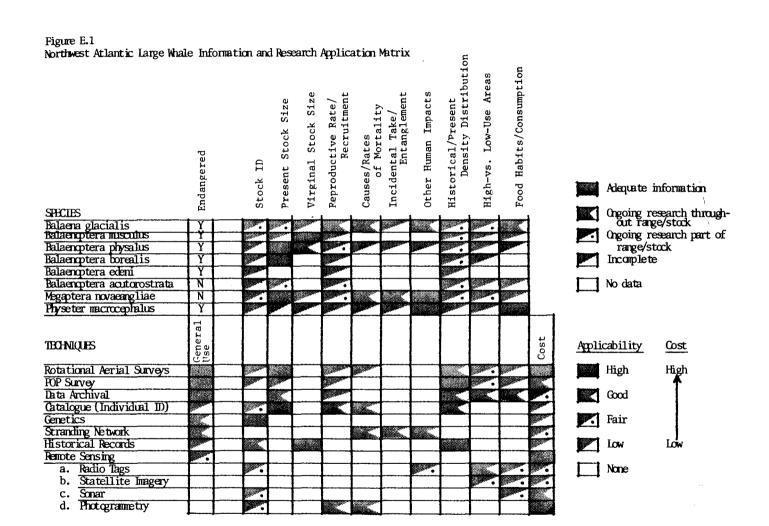Figure A.1 The northeast and southeast regional waters including the Gulf
of Mexico and the Caribbean. Locations mentioned in text are
shown.

Figure C.1. NE Regional Management Needs - shows potential impacts to species by a specific activity in areas of importance to the species. Matrix is based on impact, impact type, species factors (i.e., seasons spent in area, # relative to NW Atlantic population and species behavior).

Figure E.1
Northwest Atlantic Large Whale Information and Research Application Matrix

Column headers:
Endangered | Stock ID | Present Stock Size | Virginal Stock Size | Reproductive Rate/Recruitment | Causes/Rates of Mortality | Incidental Take/Entanglement | Other Human Impacts | Historical/Present Density Distribution | High-vs. Low-Use Areas | Food Habits/Consumption

SPECIES

Species	Endangered
Balaena glacialis	Y
Balaenoptera musculus	Y
Balaenoptera physalus	Y
Balaenoptera borealis	Y
Balaenoptera edeni	Y
Balaenoptera acutorostrata	N
Megaptera novaeangliae	N
Physeter macrocephalus	Y

TECHNIQUES (General Use ... Cost)

- Rotational Aerial Surveys
- POP Survey
- Data Archival
- Catalogue (Individual ID)
- Genetics
- Stranding Network
- Historical Records
- Remote Sensing
  - a. Radio Tags
  - b. Satellite Imagery
  - c. Sonar
  - d. Photogrammetry

Legend:
- Adequate information
- Ongoing research throughout range/stock
- Ongoing research part of range/stock
- Incomplete
- No data

Applicability — Cost
- High — High
- Good
- Fair
- Low — Low
- None

Appendix 1.

<p align="center">List of Participants
NEFC/SEFC Marine Mammal Research Planning Meeting
8-9 January 1985</p>

<p align="center">Southeast Fisheries Center
75 Virginia Beach Drive
Miami, Florida</p>

SEFC	G. Scott, Chairman and Editor J. Powers L. Hansen R. Owen F. Berry
NEFC	M. Sissenwine G. Waring
NWAFC/NMML	H. Braham
NERO	D. Beach
SERO	P. Raymond
NMFS Headquarters	B. Drucker

AGENDA

NEFC/SEFC Marine Mammal Research Planning Meeting

8-9 January 1985

Southeast Fisheries Center
75 Virginia Beach Drive
Miami, Florida

9:00 am
N351 Grosvenor Hall
Rosenstiel School of Marine and Atmospheric Science

A. Welcome and Introductions

B. Objectives and Format

C. Overview

    1. NMFS National Perspective: MMPA mandates, ESA, IWC, MMC, ICES, Cartegena Convention, etc.

       i. Research Responsibilities - F/S, NWAFC/NMML
      ii. Management Responsibilities - F/M

    2. Regional Perspectives

        i. NE Management Needs and Concerns - F/NER
       ii. SE Management Needs and Concerns - F/SER
      iii. Research Addressing NER Needs - F/NEC
      iv. Research Addressing SER Needs - F/SEC

D. Summary of Current Knowledge

       i. Status of the Stocks - F/NWC, NWAFC/NMML
      ii. Additional data available or studies under
         progress - F/SEC, F/NEC

E. Identification of Data Gaps - Group

       i. Stock Structure
      ii. Abundance
    iii. MNPL
      iv. Trends
       v. Human induced mortality
     vi. Other concerns

F. Research Needed to Address Data Gaps - Group

G. Prioritization of Research - Group

H. Compilation of DRAFT Research Plan - Group